INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COMPUTER SCIENCE AND ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**ADHOC AND SENSOR NETWORKS**			
Course Code	**A80542**			
Regulation	**R13– JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	-	-	4
Course Coordinator	Mr. C. Raghavendra, Assistant Professor, CSE.			
Team of Instructors	Mr. C. Praveen Kumar, Assistant Professor, CSE.			

I. COURSEOVERVIEW

This course is offered for those who are interested in understanding and building systems support mechanisms for mobile computing systems including client-server web/database/file systems, and mobile ad hoc and sensor networks for achieving the goal of anytime, anywhere computing in wireless mobile environments. The technologies involved to realize such a system will be covered and the fundamental concepts of mobile computing are introduced. These include mobility and service management, data management, routing in mobile ad hoc and sensor networks, and security issues for mobile systems. While mobile computing covers many topics, in this course our main focus will be on mobility, data and service management, and security issues in mobile computing environments.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	4	Computer networking, Design and analysis of algorithms

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement of the semester. These are of problem solving in nature with critical thinking. Marks shall be awarded considering the average of two midterm tests in each course.	75	100

IV. EVALUATIONSCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSEOBJECTIVES:

At the end of the course, the students will be able to:

I. Understand the concept of mobile ad hoc networks, design and implementation issues and available solutions.
II. Demonstrate the routing mechanisms and three classes of approaches: proactive, on-demand, and hybrid.
III. Understand the clustering mechanisms and different schemes that have been employed, e.g., hierarchical.
IV. Explain sensor networks and their characteristics. This includes design of MAC layer protocols, understanding of power management, query processing, and sensor databases.
V. Demonstrate the designing and implementing ad hoc network functionality using network simulation tools and Pocket PCs

VI COURSEOUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. Understand the concept of mobile computing.
2. Analyze the GSM architecture, protocols and their new data services.
3. Estimate the MAC protocols for GSM and wireless LANs.
4. Identify the collision avoidance for protocols.
5. Explain about the mobile IP Network layer.
6. Classify the transport layer protocols for mobile networks.
7. Develop new ad hoc network applications and algorithms or protocols.
8. Understand and develop any existing or new protocol related to mobile environment.
9. Apply the protocols and platforms mobile computing WAP.
10. Differentiate the different operating Systems like Palm OS, Windows CE, Symbian OS, Linux for Mobile devices.
11. List out the Advanced technologies for developing the mobile networks

PO5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.	H	Assignments, Exams
PO6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	N	--
PO7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	N	--
PO8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	S	--
PO9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.	S	Tutorials, Exams
PO10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	N	--
PO11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	N	--
PO12	**Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.	S	Future scope or projects discussion

N = None **S = Supportive** **H = Highly Related**

VIII HOW PROGRAM SPECIFIC OUTCOMES AREASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficiency analysis and design of computer-based systems of varying complexity.	H	Lectures, Assignments
PSO2	**Problem-Solving Skills:** The ability to apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success.	H	Projects
PSO3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and platforms in creating innovative career paths, to be an entrepreneur, and a zest for higher studies.	S	Future scope or projects discussion

N- None **S-Supportive** **H - Highly Related**

IX SYLLABUS:

UNIT – I

Introduction to Ad Hoc Wireless Networks: Characteristics of MANETS, Applications of MANETS, Challenges

Routing In MANETS: Topology based versus position based approaches, Topology based routing protocols, and position based routing, other routing protocols

UNIT – II

Data Transmission In MANETS: The broadcast storm, Multicasting, Geocasting.

TCP Over Ad Hoc Networks: TCP protocol overview, TCP and MANETS, Solutions for TCP over Ad Hoc

UNIT – III

Basics Of Wireless Sensors And Applications: The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications.

Data Retrieval In Sensor Networks: Classification of WSNs, MAC Layer, Routing Layer, High-Level Application Layer Support, Adapting to the Inherent Dynamic Nature of WSNs.

UNIT – IV

Security: Security in Ad Hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems

Sensor Network Platforms and Tools: Sensor network Hardware, Sensor Network Programming Challenges, and Node-Level Software Platforms.

UNIT – V

Operating System-Tiny OS: Imperative Language: nesC, Data flow style language: TinyGALS, Node- Level Simulators, NS-2 and its sensors network extension, TOSSIM.

Text Books:

1. Ad Hoc and Sensor Networks: Theory and Applications, Carlos de Morais Cordeiro and Dharma Prakash Agrawal, World Scientific Publications / Cambridge University Press,2006.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science Imprint, Morgan Kauffman Publishers, 2005.

References:

1. Ad Hoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, Pearson Education, 2004.
2. Guide to Wireless Ad Hoc Networks, Sudip Misra, Isaac Woungang, and Subhas Chandra Misra, Springer International Edition, 2011.
3. Guide to Wireless Sensor Networks, Sudip Misra, Isaac Woungang, and Subhas Chandra Misra, Springer International Edition, 2012.
4. Wireless Mesh Networking, Thomas Krag and Sebastin Buettrich, O'Reilly Publishers,2007.
5. Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010.
6. Wireless Ad hoc Mobile Wireless Networks-Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
7. Wireless Ad hoc Networking, Shih-Lin Wu, Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007
8. Wireless Ad hoc and Sensor Networks–Protocols, Performance and Control, Jagannathan Sarangapani, CRC Press, Taylor & Francis Group, 2007, rp2010.
9. Security in Ad hoc and Sensor Networks, Raheem Beyah, et al., World Scientific Publications /Cambridge University Press, 2010

VIII. COURSEPLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture No.	Topics to be covered	Course Learning Outcomes	Reference
1-2	Introduction to Ad Hoc Wireless Networks, Characteristics of MANETS	Explain the concept of ad-hoc and sensor networks	T1:1.1-1.2 T2:1.2
3-4	Applications of MANETS, Challenges	Explain the applications and typical node and network architectures.	T1:1.3-1.4
5-10	Topology based versus position based approaches, Topology based routing protocols	Explain Topology based protocol design issues and protocol designs for wireless sensor networks	T1:2.2-2.3
11-15	Position based routing, Other routing protocols	Demonstrate Position based protocol design issues and protocol designs for wireless sensor networks	T1:2.4-2.5
16-25	Introduction, The broadcast storm, Multicasting, Geo-casting.	Demonstrate how the data is transmitted in ad hoc networks.	T1:3.1-3.4
26-28	Introduction, TCP protocol overview, TCP and MANETS Solutions for TCP over Ad Hoc	Explain the TCP protocol and its uses in MANETS	T1:7.1-7.3 T1:7.4
29-31	Introduction, The Mica Mote, Sensing and Communication Range, Design Issues	Describe sensing and communication ranges in wireless sensor networks.	T1:8.1--8.4
32-35	Energy Consumption, Clustering of Sensors, Applications.	Explain clustering and its techniques for energy consumption.	T1:8.5-8.7
36-43	Classification of WSNs MAC Layer, Routing Layer, High Level Application Layer Support Adapting to the Inherent Dynamic Nature of WSNs.	Explain MAC and routing protocols for sensor and mobile networks.	T1:9.2-9.6
44-48	Security in Ad Hoc Wireless Networks, Key Management	Explain security flow of wireless network protocols and key management	T1:10.3-10.4
49-51	Secure Routing, Cooperation in MANETs Intrusion Detection Systems.	Examine security in MANETS and its protocols.	T1:10.5 -10.6 T1:10.8
52-54	Sensor network Hardware, Sensor Network Programming Challenges	Demonstrate the various hardware platforms that exist for sensor networks and its programming challenges.	T1:7.6-7.7
55	Node-Level Software Platforms.	Illustrate the various software platforms that exist for sensor networks	T1:7.8-7.9
56-58	Imperative Language: nesC, Data flow style language.	Demonstrate design and implement sensor network protocols in the nesC/TinyOS environment.	T1:10.1-10.5
59-62	Tiny GALS, Node-Level Simulators,ns-2 and its sensors network extension TOSSIM	Demonstrate design and implement sensor network protocols in the nesC/TinyOS environment.	T1:10.6-10.13 T2:9.1

IX. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OFPROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I		S		H						S	S		H		
II	S			H									H		
III									S	S					S
IV	S														
V			S				H						H		

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X. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OFPROGRAM OUTCOMES AND PROGRAM SPECIFICOUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1					S									S	
2					S								S		
3		H											H		
4		H											H		
5										S	S			S	
6			S										S		
7		S												S	
8									S					S	
9		S												S	
10			S											S	
11			S											H	

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Prepared by: Mr. C. Raghavendra, Assistant Professor.

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